भारतीय मानक
Indian Standard

IS 10751 : 2022

जलोढ़ नदियों के गाइड तटबंध की योजना और डिजाईन — दिशानिर्देश

(दूसरा पुनरीक्षण)

Planning and Design of Guide Banks for Alluvial Rivers — Guidelines

(Second Revision)

ICS 93.140

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Flood Management, Erosion Management and Diversion Works Sectional Committee, WRD 22

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the flood Management, Erosion Management and Diversion Works Sectional Committee, had been approved by the Water Resources Division Council.

Indian rivers in plains are often shallow and flow in a wide alluvial belt, with meandering and/or braiding characteristics. To construct an engineering structure across rivers, it is often found economic to narrow down its section and restrict its course of flow centrally through the structure built over it. This can be achieved by construction of heavy embankments, called 'Guide Banks'.

Guide banks are thus meant to confine and guide the river flow through the structure without causing damage to it and its approaches. They also prevent the outflanking of the structure.

Guide banks form one of the major and vital constituent of river training works and often a substantial amount of cost of project is spent on them. Thus it is imperative that they must be designed in the most economic and efficient manner.

As a result of researches conducted by various organizations in India and by the knowledge and experience gained from the banks constructed in the past, attempt has been made in this standard to evolve more rational criteria of design for guide banks. Thus the provisions laid down in this standard are recommendatory in nature, and are intended to lay down guidelines for design, where much depends on the experience and ingenuity of engineers involved in design.

This standard was first published in 1983 and its first revision was made in 1994. In view of the various technological changes that has taken place in this field since 1994 and also to incorporate the latest practices, this second revision has been taken up. There is no ISO standard on the subject. This standard has been prepared based on indigenous data/practices prevalent in the field in India. The details regarding construction and maintenance of guide banks have been covered in IS 12926 'Construction and maintenance of guide banks in alluvial rivers — Guidelines (*first revision*).

The committee responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PLANNING AND DESIGN OF GUIDE BANKS FOR ALLUVIAL RIVERS — GUIDELINES

(Second Revision)

1 SCOPE

This standard covers planning and design of guide banks used for the various engineering structures constructed on the alluvial rivers.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
4410 (Part 3) : 1988	Glossary of terms relating to river valley projects: Part 3 River and river training (*first revision*)
8237 : 1985	Code of practice for protection of slope for reservoir embankment (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the terms defined in IS 4410 (Part 3) shall apply.

4 GENERAL DESIGN FEATURES

4.1 Guide banks are constructed to guide the flow normal to the axis of structure as far as possible both upstream and downstream of structure, on one or both flanks as required.

4.2 Alignment

4.2.1 The alignment should be such that the flow is uniform with minimum return currents.

4.2.2 The alignment and layout are best decided based on model studies.

4.2.3 In case of a head regulator of a canal, constructed adjacent to the main structure, the alignment of the guide bank should further endeavor to induce favorable flow conditions for the entry of water with minimum silt into the canal. Attempt should be made to induce flow curvature such that coarser particles moving as bed load move away from head regulators and flows towards under sluices/river sluices.

4.2.4 In other cases, guide banks should be so aligned that the flow is uniformly distributed across the waterway as far as possible.

4.3 Classification of Guide Banks

Guide banks can be classified according to:

a) Form in plan, and
b) Geometrical shape.

4.3.1 *According to Form in Plan*

Guide banks can be convergent, divergent or parallel as shown in Fig. 1.

4.3.1.1 *Convergent guide banks*

Convergent guide banks exercise an attracting influence on flow and they may be used where the river has already formed a loop and the approaching flow has become oblique to keep flow active in bays adjacent to them. However, the approach embankment gets relatively lesser protection in worst possible embayment compared to equal bank length of parallel guide banks (*see* Fig. 2).

Convergent guide banks require a longer length in comparison to parallel guide banks for the same degree of protection to approach embankments. However, hydraulically they give better distribution of flow across the waterway.

4.3.1.2 *Parallel guide banks*

Parallel guide banks with suitably curved heads have been found to give uniform flow from the head of the guide banks to the axis of the structure.

4.3.1.3 *Divergent guide banks*

Divergent guide banks have disadvantage of excessive attack and heavy scour at the head and shoaling all along the bank rendering the end bays inactive. Angle of divergence should not exceed to avoid any flow separation.

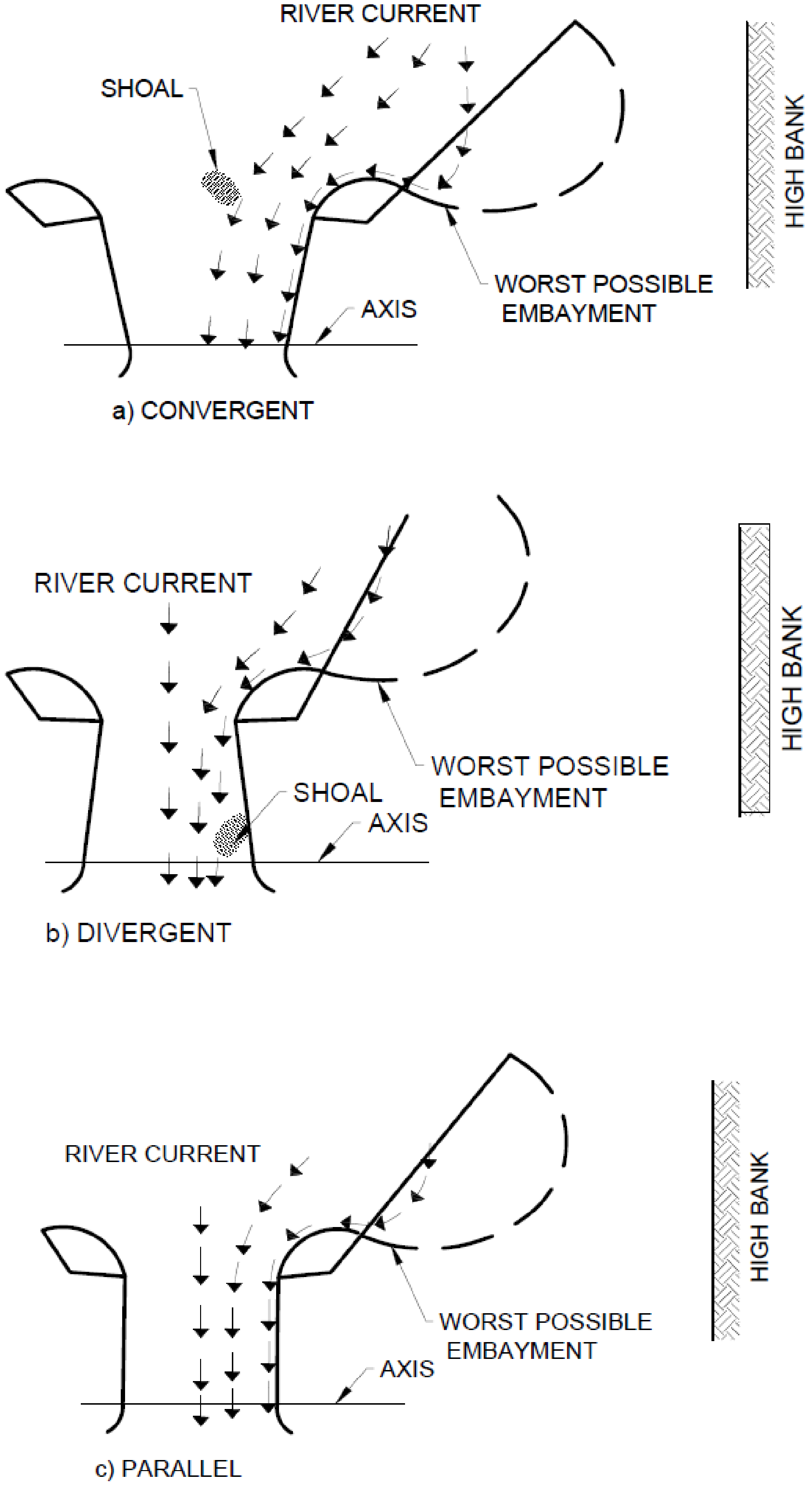


FIG. 1 DIFFERENT FORMS OF GUIDE BANKS

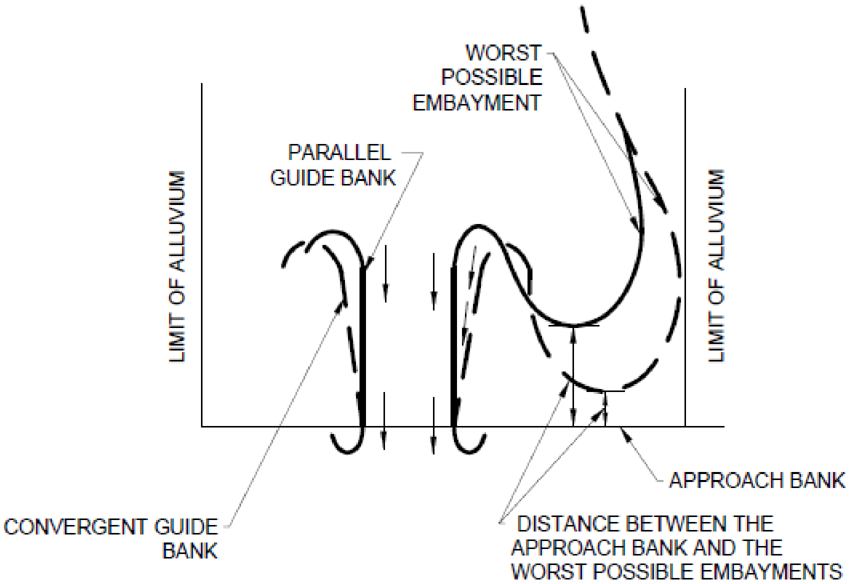


FIG. 2 EXTENT OF PROTECTION PROVIDED BY PARALLEL AND CONVERGENT GUIDE BANKS

4.3.2 *According to Geometrical Shape*

The guide banks can be straight or elliptical with a circular or multi-radii curved head (*see* Fig. 3). Elliptical guide banks have been found more suitable in case of wide flood plain rivers with better hydraulic performance. In case of elliptical guide banks, the ratio of major axis to the minor axis is generally in the range of 2 to 3.5.

Due to gradual change in curvature in elliptical guide banks the flow keep close to the guide banks all along its length as against separation of flow occurring in case of straight guide banks after the curved head which leads to obliquity and non-uniformity in flow. The details of the length of guide banks *versus* different discharge in elliptical guide banks are shown in Fig. 4.

4.4 Other Type of Guide Banks

Other type of guide banks differing in form mentioned in **4.3.1** or shape mentioned in **4.3.2** may be provided if warranted by site conditions and supported by the model studies.

4.5 Length of Guide Banks

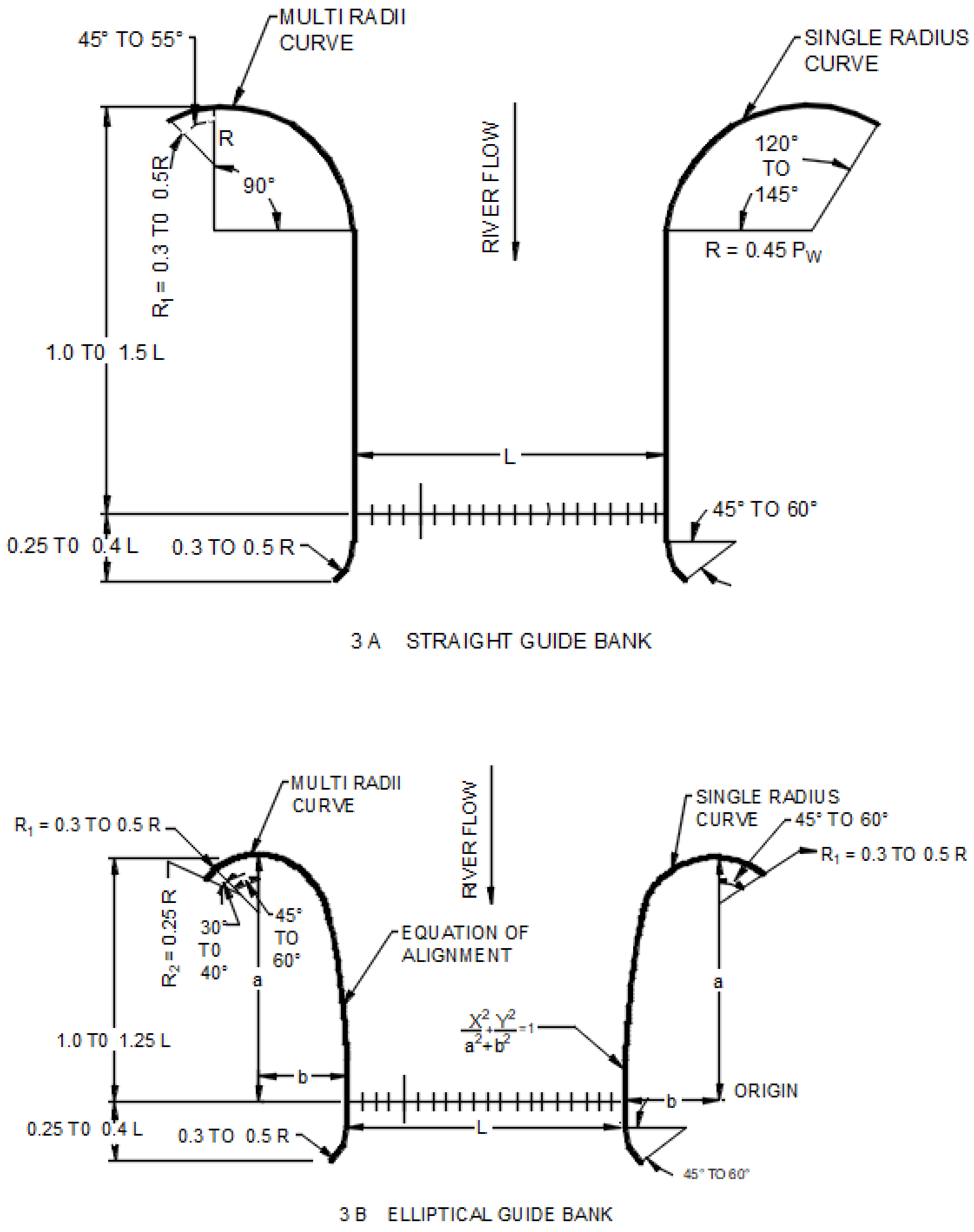
4.5.1 *Upstream Length*

4.5.1.1 The general practice is to keep the upstream length of guide banks as 1.0 *L* to 1.5 *L,* where *L* is the length of structure between the abutments. For elliptical guide banks the upstream length (that is semi major axis *a)* is generally kept as 1.0 *L* to l.25 *L.* This practice is generally applicable where the waterway (*L*) is within the close range of Lacey's waterway (*Pw*).

4.5.1.2 For wide alluvial belt, the length of guide banks should be decided from two important considerations, namely (a) the maximum obliquity of current (it is desirable that obliquity of flow to the river axis should not be more than 30°), and (b) the limit to which the main channel of the river can be allowed to flow near the approach embankment in the event of the river developing excessive embayment behind the guide bank. The radius of worst possible loop should be ascertained from the data of acute loops formed by the river during past. In case of river where adequate past surveys are not available, the radius of worst loop can be determined by dividing the average radius of loop worked out from the available surveys of the river by 2.5 for river having a maximum discharge up to 5 000 m^3/s and by 2.0 for discharging above 5 000 m^3/s. The above considerations are illustrated in Fig. 5.

The limit to which the main channel of the river can be allowed to flow near approach embankment should be decided based on importance of structure and local conditions.

4.5.1.3 In cases where the detailed examination in accordance with **4.5.1.2** is difficult data, as a general guide the upstream length of the guide bank may be kept 1.0 *L* to 1.5 *L.* The upstream length of elliptical shaped guide bund can be found by using Lagasse's curve. Length and shape of upstream guide bund should be finalized as per result of model study to ensure smooth uniform flow through the barrage/bridge and to minimize the risk of any outflanking of the structure, especially where there is high restriction/contraction of normal waterway at design flood.

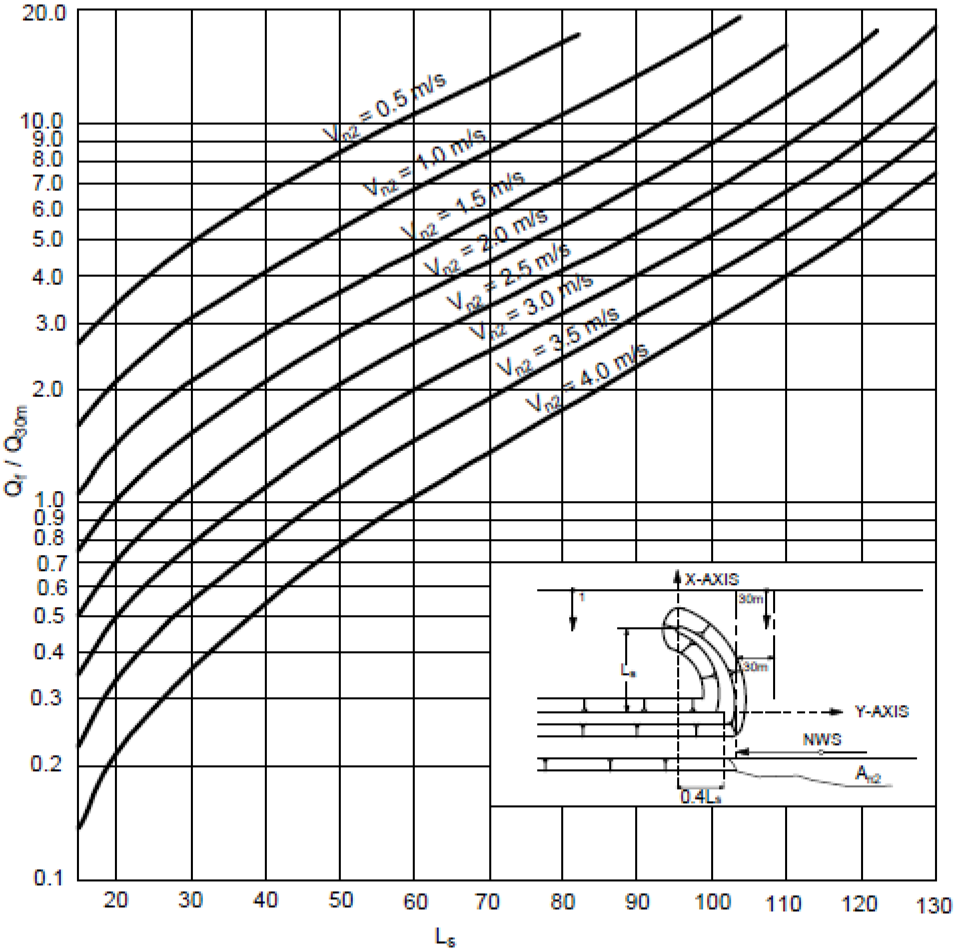


where

R = 0.45 P_W

P_W = WETTED PERIMETER CORRESPONDING TO LACEY'S WATERWAY

FIG. 3 GEOMTERICAL SHAPES OF GUIDE BANKS



A_{n2} = Sectional flow area (m^2) at the site through the opening before the construction of structure,

Q_f = Lateral or floodplain discharge of either floodplain intercepted by the embankment in m^3/s,

$Q_{30\ m}$ = Discharge in 30 m of the stream adjacent to abutment in m^3/s, and

Q = Total discharge in the stream in m^3/s.

FIG. 4 DETAILS OF LENGTH OF ELLIPTICAL GUIDE BANKS v/s DIFFERENT DISCHARGES

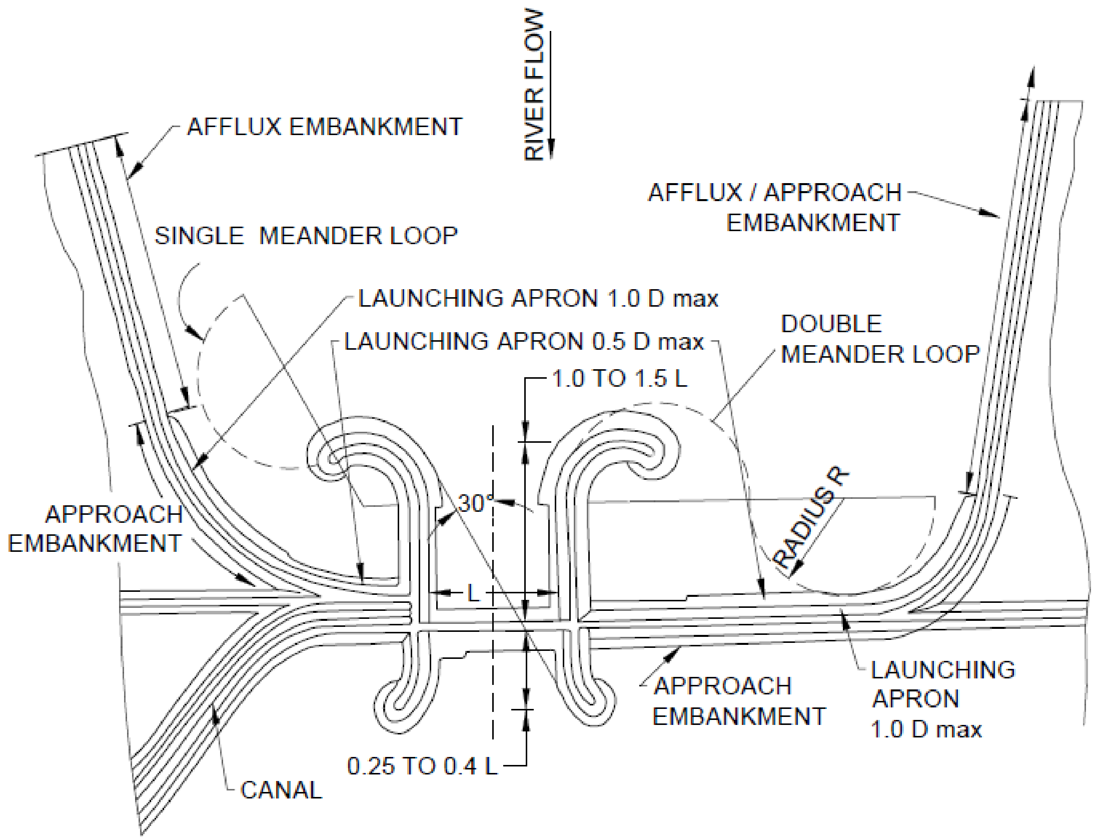


Fig. 5 Typical Layout Plan of Guide Bank for Barrage

4.5.2 *Downstream Length*

On the downstream side, the river tries to fan out to regain its natural width. The function of guide bank is to ensure that the river action does not adversely affect the approach embankment. The downstream length will therefore, has to be determined so that swirls and turbulence likely to be caused by fanning out of the flow downstream the guide bank do not endanger the structure and its approach. The length of 0.25 L to 0.4 L is recommended. Where there is high degree of restriction/contraction of normal waterway resulting in high afflux and choking of flow, the downstream end of guide bund should be splayed gently (not exceeding 5°-10°) for proper diffusion of flow. The downstream length of guide bund should be finalized after model study.

4.5.3 In all important cases the lengths, both upstream and downstream, should be decided based on results of model studies incorporating the past history of river in the reach where the structure is proposed.

4.6 Radius of Curved Head and Tail

4.6.1 Function of curved head is to guide river flow smoothly and axially to the structure, keeping end spans active. If the radius of curvature is too small, the flow will separate at head resulting in flow obliquity and therefore larger radius is needed to attract and guide the flow, though uneconomical. Radius should be kept as small as possible in consistent with proper functioning of bank. Radius of curve head equal to 0.45 (Pw) has been found to be satisfactory.

4.6.2 Radius of curved tail may be 0.3 to 0.5 times the radius of curved head.

4.6.3 Considerable economy consistent with smoother conditions at the head may be achieved by adopting a composite curve of two or three different radius instead of a single large radius. This can be best decided by model studies.

4.7 Sweep Angle

The sweep angle is related to the loop formation ranging from 120° to 145° according to river curvature.

For curved tail it varies from 45° to 60°. Sweep angle for upstream and downstream heads of guide bunds should be finalized from model study.

5 DESIGNS OF GUIDE BANKS

5.1 Material

Guide banks may be made of locally available materials from river bed, preferably silt, or sand-cum-gravel.

5.2 Top Width

The top width should be 6 to 9 m to permit transport of material. At the nose of guide banks, the width may be increased suitably to enable vehicles to take turn and for stacking stones.

5.3 Free Board

A free board of 1.0 m to 2.0 m may be provided above the design flood level. Where heavy wave action is apprehended and/or aggravation is anticipated, a higher free board may be provided.

5.4 Side Slope

It depends on the angle of repose of the material of guide banks and the height. Side slopes of 2 : 1 to 3 : 1 are generally recommended, however, stability analysis under different operating conditions should be carried out to find factor of safety which should not be less than 1.1.

5.5 Protection of Structures

5.5.1 Curved head is prone to damage due to sand concentration of discharge caused by collection of over bank flow and direct attack of current obliquely. The shank is subjected to attack by parallel/oblique flow. The curved tail is subject to attack by fanning out of current.

5.5.2 The effect of these attacks is the formation of deep scour holes at toe and erosion of river side slopes. Hence toe and slope both have to be protected.

5.6 Toe Protection

Launching apron/cut-off/toe trench should be provided for protection of toe and it should form a continuous flexible cover over the slope of the scour hole in continuation of pitching up to the point of deepest scour. Launching apron should be laid at normal low water level, or at as low a level as techno-economically viable. The stone in the apron should be designed to launch along the slope of the scour hole so as to provide a strong layer that may prevent further scooping out of the river bed material. The size and shape of apron depends on the size of stone, thickness of launched apron, the depth of scour and slope of launched apron. Wire crated stone gabions laid over geo-synthetic Textiles can also be used as apron for toe protection.

5.6.1 *Size of Stone*

The required size of stones, concrete blocks, crates, etc. can be determined as follows:

The weight of the stones required on sloping surface to withstand erosive action of flow may be determined using following relationship.

$$W = \frac{0.02323\, S_s}{\left[K(S_s - 1)^3\right]} V^6$$

$$K = \left[1 - \frac{\sin^2\theta}{\sin^2\phi}\right]^{1/2}$$

where

W = weight of stone, in kg;

ϕ = angle of repose of protection material;

θ = angle of sloping bank;

S_s = specific gravity of stones; and

V = velocity, in m/s.

If the weight of the stone calculated is not available or is difficult to handle, stone crates can also be provided. In case of crates filled with stones the bulk specific gravity of the protection is required to be worked out to account for the porosity. The empirical relation for the porosity *'n'* is given below.

$$n = 0.245 + \frac{0.0864}{(d_{50})^{0.21}}$$

Where, d_{50} is the mean diameter of stones used in crate in mm.

The crate openings should not be larger than the smallest size of stone used. The mass specific gravity of the protection can be worked out using following relationship:

$$S_m = (1 - n)\, S_s$$

For working out volume of crates, S_m should be used instead of S_s. Shape of crates or blocks should be cubical as far as possible. Crates may be made of G.I. wire or nylon ropes of adequate strength and should be with double knots and close knits.

5.6.2 *Thickness of Launched Apron*

The thickness of launched apron (T_a) would depend upon the thickness of the pitching on slope (T). In the case of free dumping stones, thickness of pitching on slope should be equal to two layers of stones determined for velocity as indicated in **5.6.1**. Thickness

of protection layer should be checked for negative head created due to velocity from following formula:

$$T = \frac{V^2}{2g\,(S_s - 1)}$$

where

V = Mean velocity, in m/s;

T = Thickness of pitching, in m;

S_s = Specific gravity of stones;

T_a = 1.25T to 1.50T; and

T_a = Thickness of launching apron.

In the case of crates, the thickness of crates be decided on the basis of the above formula subject to the condition that the mass of each crate shall not be less than that determined on the basis of velocity consideration in **5.6.1**.

The thickness of the launched apron should be 25 to 50 percent more than the thickness of the pitching on the slopes. Crated boulders over geo-textile/geo-fabric filter may be used in launching apron. Sand layer of 15-20 cm may be used over geo-textile/geo-fabric filter as a cushion.

5.6.3 *Depth of Scour*

The extent of scour depends on angle of attack, discharge intensity, duration of flood and silt concentration, etc.

The regime depth R may be determined as given below:

a) for waterway equal to or more than Lacey's waterway, $R = 0.473\ [Q/f]^{1/3}$; and
b) In case where the waterway is less than Lacey's waterway and also the flow is non-uniform, R may be calculated as:

$$R = 1.33\ [q^2/f]^{1/3}$$

where:

R = scour depth, in m;

Q = discharge, in cum/s;

f = silt factor = $1.76\sqrt{d_{50}}$ where d_{50} is the mean diameter of river bed material, in mm; and

q = intensity of discharge, in cum/s/m.

c) The depth of design scour for different portions of the guide banks may be adopted as below:

Location	*Design scour depth below HFL to be adopted*
Upstream curved head of guide bank	2.0 R to 2.5R
Straight reach of guide bank to nose of downstream guide bank	1.5 R
Downstream curved tail of guide bank	1.5 R to 1.75R

5.6.4 *Slope of Apron after Launching*

The slope of launched apron may be taken as *2H : 1V* for loose boulders or stones and *1.5H : 1V* for concrete blocks or stones in wire crates. Adequate quantity of stone for the apron has to be provided to ensure complete protection of the whole of the scoured face according to levels and slopes as determined in **5.6.3**.

5.6.5 *Size and Shape of Launching Apron*

5.6.5.1 After determining the thickness of launched apron as described in **5.6.2** and the level of design scour to be adopted for different portions of the guide banks as described in **5.6.3**, the quantity of stone required for apron from laid level to design scour level can be calculated. The quantity of stone so calculated may be provided in a wedge shape having a width of 1.5D_s (Fig. 6) and average thickness T. Thickness of laid apron may be kept 0.8 T near the toe of the guide bank and 1.2 T at the river end.

5.6.5.2 Minimum loss of stones occurs when the apron is placed at the lowest possible level since the launching is minimum. Apron should be laid at as low level as economically.

5.6.5.3 At curved head, the apron has to cover large area in launched position, so that thickness may be increased taking increased length in consideration.

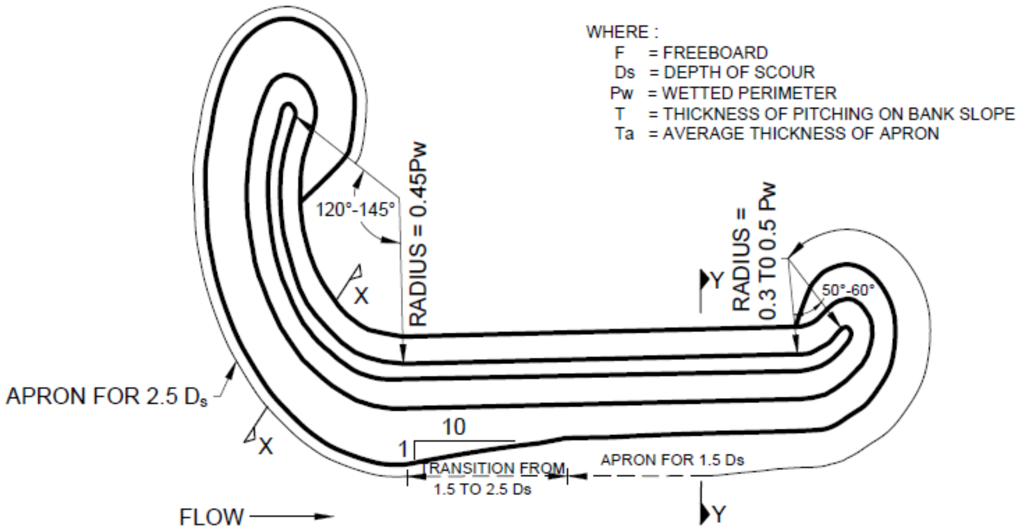
5.6.5.4 At the junction of head and shank normally high velocity exist and design scour depth varies from 2.5 R to 1.5 R. This transition should be effected in a length of one-fourth of radius of head from the head towards the shank (*details are shown in Fig*. 6).

5.7 Slope Protection

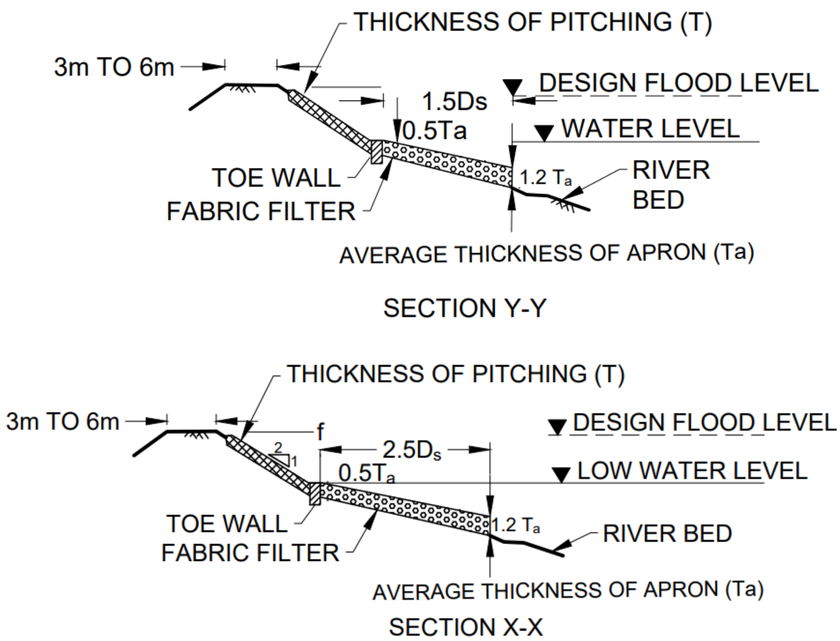
The river side earthen slope of guide banks are protected against river action by covering them with dumped or hand placed stones and concrete blocks. This pitching is intended to remain in its laid position (*see* Fig. 6). Protection is needed on the country side (*rear side*) of the guide bund near the u/s and d/s heads.

5.7.1 The rear slopes of guide banks are not subjected to direct attack of river and may be protected against wave splashing by 0.3-0.6 m thick cover of spawls or by turfing. In case, where, a parallel or back flow leading to erosive action is likely evident from model studies at the rear face, suitable pitching may be provided.

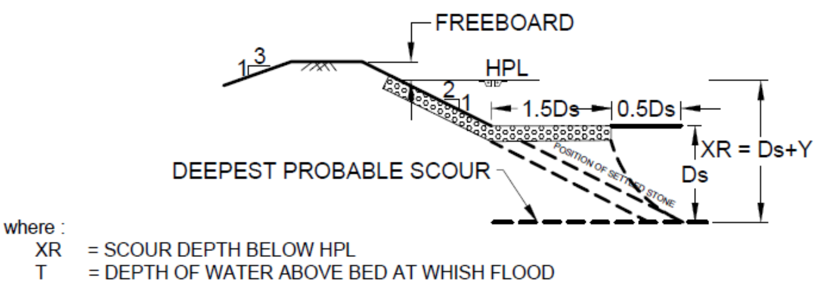
5.7.2 For the design of pitching on the river side, factors that affect are size or mass of the individual stone, its shape and gradation, thickness and slope of pitching and type of filter underneath. The predominant flow characteristic which affects the stability of pitching is velocity along the bund. Other factors like obliquity of flow, eddy action, waves etc, are indeterminate and could be studied on models and may be accounted for by providing adequate margin of safety by increasing the design mean velocity while determining the size and mass of stone.



a) Plan of Guide Bund



b) Typical Details of Guide Bank (For 2:1 Slope of Launched Apron and Scour)



c) Typical Diagram of Scour Depth (D_s)

FIG. 6 TYPICAL PLAN AND SECTION OF GUIDE BANKS

5.7.2.1 Sizes for hand placed pitching can be less due to interlocking effect which offers greater resistance to movement of stones.

5.7.3 The thickness of the pitching should be equal to the size of stone determined from the velocity consideration as indicated in **5.6.1** and **5.6.2**. For dumped stone pitching the thickness may be two times the size of stone. In general the following guidelines are adopted:

a) Brick on edge can be adopted up to an average velocity of 2 m/s, and
b) For higher velocity cement concrete blocks/crated stone could be used.

NOTE — Round and smooth boulders should be avoided particularly for hand placing.

5.8 Drainage Arrangement

A system of open paved drains (*Chutes*) along the sloping surface terminating in longitudinal collecting drains at the junction of berm and slope should be constructed at every 30 m (c/c) distance to drain the rain water. The drains are to be formed of stone pitching or with precast concrete section. The crest of guide bank should be sloped 1:50 from upstream to downstream (river side to country side) and longitudinal paved drains according to approved drawing are to be constructed at downstream/country side edge of the crest. These longitudinal drains should drain the rainwater in chute drain.

6 DESIGN OF FILTER

A graded filter generally specifying the standard criteria conforming to IS 8237 should be provided below the protection. The filter is required below pitching on the slope as well as below the apron also. The use of synthetic filter is preferable from the point of quality control and convenience of the laying. The criteria for synthetic filter are given in Annex A. A 15 cm thick sand layer should be provided on the filter to prevent the mechanical rupture of the fabric by armoured layer.

7 MODEL STUDY

Final layout and design of guide banks shall be decided after carrying out model study of the structure or a sectional model study of abutments, guide banks, approach embankment and a few piers adjoining the abutments, depending upon size of the river. In the case of a barrage, attempt should be made to induce flow curvature so that coarser particles move away from the head regulators. Where the river is in a meandering state and the structure is near the outer bank (concave bank) with wide flood plain, sometimes spurs are to be provided for preventing further scouring of bank and further migration of meander laterally. This may result in damage to the abutment and approach embankment. There is also a risk of outflanking of the structure. The layout, length and spacing of spur field to avoid such situation should be decided by model study- both physical and mathematical.

ANNEX A

(*Clause* 6)

CRITERIA FOR SELECTION OF FILTER FABRIC

Geo-textile filters may be recommended because of ease in installation and their proven effectiveness as an integral part of protection works. The following criteria, depending on the gradation of bed material, may be used to select the correct filter fabric:

a) For granular material containing 50 percent or less fines by weight, the following ratio should be satisfied:

$$\frac{85\,\%\ \textit{passing size of bed material}\ (\textit{mm})}{\textit{Equivalent opening size of fabric}\ (\textit{mm})} \geq 1.0$$

In order to reduce the chances of clogging, no fabric should be specified with an equivalent opening size smaller than 0.149 mm. Thus, the equivalent opening size of fabric should not be smaller than 0.149 mm and should be equal to or less than 85 percent passing size of bed material.

b) For bed material containing at least 50 percent but not more than 85 percent fines by weight, the equivalent opening size of filter should not be smaller than 0.149 mm and should not be larger than 0.211 mm.

c) For bed material containing 85 percent or more of particles finer than 0.074 mm, it is suggested that use of non-woven geo-fabric filter having opening size compatible to the equivalent values given in (a) above may be used.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSTION

Flood Management, Erosion Management And Diversion Works Sectional Committee, WRD 22

Organization	*Representative(s)*
Central Water Commission, New Delhi	Shri Ravindra Singh (***Chairman***)
Bhakra Beas Management Board, Nangal Township	Shri H. L. Kamboj
Border Roads Organization, New Delhi	Shri Mukul Kumar Mishra Shri R. K. Garg (*Alternate*)
Brahmaputra Board, Govt of India, Guwahati	Shri P. Manroi Scott Shri Gaya Prasad Singh (*Alternate*)
Central Water and Power Research Station, Pune	Dr R. G. Patil Shri Arun Kumar (*Alternate* I) Shri B. Raghuram Singh (*Alternate* II)
Central Soil and Materials Research Station, New Delhi	Dr R. Chitra Dr Manish Gupta (*Alternate*)
Central Water Commission, New Delhi	Shri Piyush Kumar Shri Samir Kumar Shukla (*Alternate* I) Shri V. D. Roy (*Alternate* II)
Delhi Technological University, New Delhi	Head Civil Engg Deptt
Ganga Flood Control Commission, Patna	Shri Sher Singh Shri Ajit Kumar (*Alternate*)
HPPCL Sundernagar	Shri Er R. P. Sharma Shri Er Arun Kapoor (*Alternate*)
ICT Pvt Ltd, New Delhi	Shri Suraj Verma Shri Vivek Jain (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Prof A. K. Keshari
Indian Institute of Technology, Roorkee	Prof Arun Kumar Prof S. K. Mishra (*Alternate*)
Water Resources Department, Govt of Andhra Pradesh	Superintending Engineer (B & C) Superintending Engineer (DAMS) (*Alternate*)
Department of Water Resources, Government of Punjab	Shri Jagjit Singh Bains Shri Davinder Singh (*Alternate*)
Department of Irrigation & Flood Control, Government of Jammu & Kashmir	Shri Ashok K. R. Gandotra Shri Ashok Kumar Sharma (*Alternate*)
Irrigation & Water Resources Department, Government of Haryana,	Shri Sandeep Taneja Shri Pardeep Yadav (*Alternate*)
Irrigation Research Institute, Roorkee	Shri Dinesh Chandra, Shri R. C. Gupta (*Alternate*)
Kolkata Port Trust, Kolkata	Dr Manas Kumar Shri Debasish Guha (*Alternate*)
Ministry of Railways (RDSO), Lucknow	Director (B & S)/CB-II Asstt.design Engineer (B & F) (*Alternate*)
NHPC Ltd Faridabad	Shri Mahesh Kumar Ms Shveta Khera (*Alternate* I) Shri Anuj Kumar Jha (*Alternate* II)

Organization	*Representative(s)*
Ranjit Sagar Dam Design Organisation, Chandigarh (RSDD)	Shri K. K. Gupta Shri S. S. Khora (*Alternate*)
Sardar Sarovar Narmada Nigam Limited, Gandhinagar	Shri Kiran Kumar Shri K. B. Parmar (*Alternate*)
Terre Armee India, New Delhi	Shri Atanu Adhikari Shri Prince Joshi (*Alternate*)
Tehri Hydro Development Corporation Ltd, Rishikesh	Shri Atul Jain Shri Neeraj Agrawal (*Alternate* I) Shri Amit Shyam Gupta (*Alternate* II)
Water Resources Deptt Govt of Maharashtra, Nashik	Shri R. V. Giriwar Shri R. A. Shimpi (*Alternate*)
Water Resources Development Organization, Wrdo, Bengaluru	Shri Shankaregowda Shri Er Amelia Balraj (*Alternate*)
Water Resources Organization, Government of Tamilnadu	Er N. Pandian
In Personal Capacity	Prof S. K. Mazumder
In Personal Capacity	Shri Dhrubjoyoti Borgohain
In Personal Capacity	Dr Nayan Sharma
BIS Directorate General	Shri Dwaipayan Bhadra, Scientist 'E' and Head (WRD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Dushyant Prajapati
Scientist 'D' (WRD), BIS

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Amendments Issued Since Publication

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